JPEG 2000 FAQ

What is JPEG 2000?

JPEG 2000 (JP2) is a new wavelet image compression standard adopted by the Joint Photographic Experts Group. Part I of this new standard, covering the basic encoding technology and format, was published in 2000 as ISO/IEC 15444-1. This new format, identified by the new ".jp2" file extension, offers many more features than traditional JPEG, including lossless encoding, higher quality compression, multiresolution representations, selective decoding, and support for pixel datatypes and colorspaces.

What are the differences between JPEG 2000 and MrSID?

JPEG 2000 and MrSID are similar in that they both use wavelet encoding algorithms that support lossless encoding, multi-resolution representations, and selective decoding. The JPEG 2000 format allows you to fine tune your encoding settings that produce excellent performance for certain situations, but at the expense of potentially poor performance in others. The MrSID format, on the other hand, is designed to provide good, but not necessarily excellent, performance across all workflows.

How can I create JPEG 2000 files in GeoExpress?

GeoExpress provides an easy-to-use graphical interface and a number of preset combinations of encode settings called "profiles" so that you can convert imagery to the JPEG 2000 format in addition to LizardTech's MrSID format.

Can I create mosaics in JP2 format using GeoExpress?

Yes! With GeoExpress 5.0, you can select JP2 as a mosaic output format just as you would for MrSID.

What about geospatial metadata?

Because JPEG 2000 is not designed for any one specific application domain, there is no provision for storing important information like the geographic position of the image and the projection system being used. Simple approaches like external "world files" and embedded GeoTIFF tags are being used in some projects, but these are not standardized in any formal way. LizardTech's JP2 implementation adds classical GeoTIFF-style metadata to JP2 images, and also provides the option to create JP2 World (.j2w) files.

Geographic metadata is already well supported by the NITF format, so wrapping the JP2 data in an NITF header is one option. Another option being pursued within the Open Geospatial Consortium (OGC) is to use the Geographic Markup Language (GML), an ISO standard designed to express just this kind of metadata. Since the JPEG 2000 committee defined the file format to allow user-defined XML to be stored within a JP2 file, this seems a natural fit.

Can I compress multispectral data to JPEG 2000?

Yes! LizardTech's GeoExpress product allows you to encode n-banded imagery to JP2 format. When encoding, you will have the option to encode 1, 3, or all bands to JP2 format. In GeoExpress 5.0, all bands must be encoded using the same compression ratio.

How do I view a JPEG 2000 image?

The easiest way to view JPEG 2000 images is to use the same LizardTech ExpressView Browser Plug-in you use to view your MrSID images. LizardTech's Express Server 5.0 also supports serving JP2 images in addition to MrSID and DjVu files. Finally, a variety of GIS applications are adding support for JP2 in their latest releases.

What is Part 1 conformance?

Part 1 of the JPEG 2000 specification dictates the overall file structure of a JPEG 2000 image and the "JP2" extension. A viewer that conforms to Part 1 of the JPEG 2000 specification will be able to open JP2 files that are created with a Part 1 conformal encoder.

Are all Part 1 JPEG 2000 images the same?

No. While Part 1 of the JPEG 2000 specification dictates the overall structure of a JP2 file, it does not specify the precise wavelet algorithm and compression ratio that should be used, nor any of the myriad other options that can be used in the creation of a JP2 file, such as codeblock size, progression order, precincts, and quality layers. Therefore, depending on the underlying architecture of the encoder, two JP2 images can be the same size but can look drastically different. This is similar to the old JPEG standard, where depending on the compression algorithm used, two JPEG images could look very different even when their file size was the same.

Isn't JPEG 2000 free since it is an ISO standard?

No. The ISO standard simply dictates the overall structure of a JP2 file. The vast majority of users will need to use some sort of commercial software to create JP2 files. Additionally, depending on who the files will be delivered to or used by, there may be additional complex encoding options that need to be specified to conform to customer need. In order to make these numerous options easier to manage, some encoding parameters are being defined, such as the NPJE specification.

What are NPJE and EPJE?

NPJE and EPJE are specifications designed to "standardize" the JPEG 2000 ISO standard. NPJE stands for "NSIF/BIIF/NITF Preferred JPEG 2000 Encoding" and is a standard that NATO and the National Geospatial-Intelligence Agency (NGA) have defined for how JPEG 2000 images should be encoded for certain workflows.

NPJE stands for "NSIF/BIIF/NITF Preferred JPEG2000 Encoding," and is a standard that NATO and the NGA (National Geospatial-Intelligence Agency) have defined for how JPEG 2000 images should be encoded for certain workflows. NPJE is optimized for fast image browsing and panning at high resolutions. Because this standard may cause poor performance in other workflows, NGA is currently

considering another standard called EPJE (Exploitation Preferred JPEG Encoding) that would be optimized for viewing imagery at low resolution.

Why should I use LizardTech's GeoExpress to create JPEG 2000 imagery?

LizardTech GeoExpress product already provides you with easy tools to compress, mosaic, and crop your geospatial imagery. Now, GeoExpress 5.0 gives you the ability to create JP2 files, and uses the same workflows you're already accustomed to for creating and editing your MrSID imagery. You can encode, mosaic, and crop your JP2 imagery as easily as you would a MrSID file. Additionally, GeoExpress gives you the ability to create NPJE and EPJE conformant files just by clicking a checkbox! You also get the ability to create and save custom JPEG 2000 encoding profiles that fit your particular project for consistent results across the project.

What is transcoding?

Because JP2 is not a static format, it allows for images to be transcoded, which means they can be further compressed, internally reorganized for more efficient use, cropped, scaled, rotated, and more, similar to the MrSID "optimize" function. These operations happen within the JP2 wavelet space; there is no need for the "decode/re-encode" process that these types of operations typically require in other formats. The innovations of the JPEG 2000 transcoder are significant enough to lead not only to faster workflows but to entirely new ones.

What's a "progression order"? Why is it important?

The "progression order" is the order in which the relevant pieces of information of the file are stored. The ordering of this information can greatly affect the speed at which you view JP2 imagery, depending on how you will be using it. For instance, one progression order may be optimized for viewing imagery while zoomed out, while another progression order may be optimized for viewing imagery at a 1:1 ratio. With JPEG 2000, the decision of progression order must be made when the imagery is encoded.

How does JPEG 2000's wavelet encoding work?

The JPEG 2000 encoding process puts image data through two key transformations: a wavelet transform and an arithmetic encoder. The pixels of the original image are first transformed to become wavelet coefficients grouped into small "blocks". Zoom levels (representations of the image at different resolutions defined by width and height in pixels) are created here in the wavelet transform stage.

Once in wavelet space, the data is run through an arithmetic encoder, which compresses the image data losslessly and arranges it in the most efficient order for access. The arithmetic encoder identifies redundancies and other inefficiencies in the strings of bits that make up the image, resulting in a smaller file size.

It's important to note that not all bits are equally important. The "most significant bits" make up the bulk of the visual representation of the image, while the "least significant bits" provide the finest degree of detail. During arithmetic encoding the data is arranged into groups called "bitplanes," such that the most significant bits are all contained together in one bitplane, the next most significant bits in another, and so on down to the last bitplane containing all the least significant bits.

A JP2 file, then, is an efficiently ordered collection of bitplanes. In lossless encoding all the bitplanes have been retained. Lossy compression is a transcoding operation that simply involves the discarding of select bitplanes and a corresponding reduction in quality or "detail". Many of the least significant bits can be discarded before the human eye begins to see any degradation in image quality.